

CONTINUING (1.53(b)) UTILITY PATENT APPLICATION TRANSMITTAL

(Only for continuing applications under 37 CFR 1.53(b))

Attorney Docket No.
1293.1130CIP

First Named Inventor:
Jung-Wan KO

Title:

RECORDING MEDIUM FOR STORING VERSION INFORMATION
FOR MAINTAINING RECORDING AND/OR REPRODUCING
COMPATIBILITY, AND METHOD AND APPARATUS FOR
MANAGING THE SAME

Express Mail Label No.

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent
application contents.

ADDRESS TO: Assistant Commissioner for Patents
Box Patent Application
Washington, DC 20231

1. ☒ Fee Transmittal Form
2. ☒ Specification, Claims & Abstract [Total Pages: 21]
3. ☒ Drawing(s) (35 USC 113) [Total Sheets: 6]
4. ☐ Oath or Declaration [Total Pages:]
 - a. ☐ Newly executed (original or copy)
 - b. ☐ Copy from a prior application (37 CFR 1.63(d)) (see Box 18)
5. ☐ This application is filed by fewer than all the inventors named in the prior nonprovisional application.
 - a. ☐ DELETE the following inventor(s) named in the prior nonprovisional application:
 - b. ☐ The inventor(s) to be deleted are set forth on a separate sheet attached hereto.
6. ☐ Incorporation by Reference (usable if Box 4b is checked)
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.
7. ☐ Microfiche Computer Program (Appendix)
8. ☐ Nucleotide and/or Amino Acid Sequence Submission (if applicable, all necessary)
 - a. ☐ Computer Readable Copy
 - b. ☐ Paper Copy (identical to computer copy)
 - c. ☐ Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

9. ☐ Assignment Papers (cover sheet & document(s))
10. ☐ 37 CFR 3.73(b) Statement (when there is an assignee) ☐ Power of Attorney
11. ☐ English Translation Document (if applicable)
12. ☐ Foreign priority benefit under 35 U.S.C. §119 is claimed.
 - a. ☐ Certified Copy of Priority Document(s) filed in prior application No. / .
 - b. ☐ Certified Copy of Priority Document(s) enclosed.
 - c. ☐ Certified Copy of Priority Document(s) to follow.
13. ☐ Information Disclosure Statement (IDS)/PTO-1449 ☐ Copies of IDS Citations
14. ☐ Preliminary Amendment
 - a. ☐ enclosed herewith.
 - b. ☐ incorporated herein (see Box 18).
15. ☒ Return Receipt Postcard (MPEP 503) (Should be specifically itemized)
16. ☐ Small Entity Statement(s) ☐ Statement filed in prior application, status still proper and desired.
17. ☐ Other:

18. CONTINUING APPLICATION, check appropriate box and supply the requisite information below:

☐ Continuation ☐ Divisional ☒ Continuation-in-part (CIP) of prior application No: 09/650,858

Prior application information: Examiner: Unknown

Group/Art Unit: Unknown

* * *

Preliminary Amendment:

☐ Cancel in this application original claims _____ of the prior application before calculating the filing fee. (At least one original independent claim must be retained for filing purposes.)

☐ Amend the specification by inserting before the first line the sentence:

--This application is a _____ of application number _____, filed _____, now _____.

**19. NEW CORRESPONDENCE ADDRESS * CUSTOMER NO. 21,171**

21171

PATENT TRADEMARK OFFICE

20. SIGNATURE OF ATTORNEY OR AGENT

NAME	Michael D. Stern	REGISTRATION NO.	37,240
SIGNATURE		DATE	10/24/00

004307" 23446360

NEW APPLICATION FEE TRANSMITTAL

Attorney Docket No. 1293.1130CIP
 Application Number To be assigned
 Filing Date October 24, 2000

AMOUNT ENCLOSED

\$

First Named Inventor Jung-Wan KO

JC041 U.S. PTO
09/694787

10/24/00

FEE CALCULATION (fees effective 10/01/00)

CLAIMS	(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) CALCULATIONS
TOTAL CLAIMS		36 - 20 =	16	X \$ 18.00 =	\$ 288.00
INDEPENDENT CLAIMS		5 - 3 =	2	X \$ 80.00 =	160.00
MULTIPLE DEPENDENT CLAIMS (any number; if applicable)				+ \$270.00 =	
				BASIC FILING FEE	710.00
				Total of above Calculations =	\$ 1,158.00
Surcharge for late filing fee, Statement or Power of Attorney (\$130.00)					+
Reduction by 50% for filing by small entity (37 CFR 1.9, 1.27 & 1.28).					-
				TOTAL FILING FEE =	\$ 1,158.00
Surcharge for filing non-English language application (\$130.00; 37 CFR 1.52(d))					+
Recordation of Assignment (\$40.00; 37 CFR 1.21(h)(1))					+
				TOTAL FEES DUE =	\$ 1,158.00

METHOD OF PAYMENT

- ☐ Check enclosed as payment.
☐ Charge "TOTAL FEES DUE" to the Deposit Account No., below.
☒ No payment is enclosed and no charges to the Deposit Account are authorized at this time.

GENERAL AUTHORIZATION

- ☒ If the above-noted "AMOUNT ENCLOSED" is not correct, the Commissioner is hereby authorized to credit any overpayment or charge any additional fees necessary to:

Deposit Account No.

19-3935

Deposit Account Name

STAAS & HALSEY LLP

- ☒ The Commissioner is also authorized to credit any overpayments or charge any additional fees required under 37 CFR 1.16 (filing fees) or 37 CFR 1.17 (processing fees) during the prosecution of this application, including any related application(s) claiming benefit hereof pursuant to 35 USC § 120 (e.g., continuations/divisionals/CIPs under 37 CFR 1.53(b) and/or continuations/divisionals/CPAs under 37 CFR 1.53(d)) to maintain pendency hereof or of any such related application.

SUBMITTED BY: STAAS & HALSEY LLP

Typed Name	Michael D. Stein	Reg. No.	37,240
Signature		Date	10/24/00

TITLE OF THE INVENTION

RECORDING MEDIUM FOR STORING VERSION INFORMATION FOR
MAINTAINING RECORDING AND/OR REPRODUCING COMPATIBILITY, AND
METHOD AND APPARATUS FOR MANAGING THE SAME

5 **CROSS-REFERENCE TO RELATED APPLICATIONS**

This application claims the benefit of U.S. Provisional Application No. 60/214,452, filed June 28, 2000, the disclosure of which is incorporated herein by reference.

This application is a continuation-in-part of U.S. Serial No. 09/650,858 filed on August 29, 2000, now pending.

10 **BACKGROUND OF THE INVENTION**

1. Field of the Invention

15 The present invention relates to an optical recording medium and recording/reproducing from the optical recording medium, and more particularly, to an optical recording medium for storing part version information for determining whether or not recording compatibility and/or reproducing compatibility can be maintained when data is recorded and updated on/reproduced from the optical recording medium, and a method and apparatus for managing the part version information.

2. Description of the Related Art

20 A recording/reproducing apparatus and a recording medium comply with a specification set at any given time, but due to the addition of new functions, and improvements in the performance of functions, the specification changes. The specification is changed in order to maintain compatibility with existing recording/reproducing apparatuses or recording media, but in some cases, partial compatibility is lost in order to extend functions or improve
25 performance.

In general, a recording medium (such as an optical disc), which complies with specifications has areas for storing a variety of information which represent the physical/logical

structure and characteristics of the recording medium, and such information includes information on allocation on the physical recording medium, information on recording/reproducing characteristics, information for managing defects, information on the organization of logical recording spaces, etc.

5 A control information zone which records this information not only has a zone for recording this information, but also a reserved zone, which enables the addition of information related to characteristics of the recording medium or recording/reproducing apparatus in accordance with newly appearing functions or improvement in performance.

10 However, when a specification is revised due to these additional functions and improvements, compatibility may not be maintained. Furthermore, handling newly added information in an existing recording medium and recording/reproducing apparatus becomes another problem.

15 In order to solve these problems, the digital versatile disc (DVD) specification makes it a rule to record part version information on a disc. As shown in FIG. 1, this information is recorded in the first byte in the physical format information of a control data block in the lead-in zone of the disc.

20 FIG. 1 illustrates part version information of the existing DVD. An ordinary DVD has a lead-in zone which is a data zone for helping recording/reproducing in the starting part of a disc. This lead-in zone has a control data block zone which can record control information. This control data block zone is again divided into a physical format information zone, a disc manufacturer information zone, and a contents provider information zone.

25 In the existing digital versatile disc-read only memory (DVD-ROM), digital versatile disc-random access memory (DVD-RAM), etc., part version information is recorded in BP0, the first byte in the physical format information zone as shown in FIG. 1. The first byte BP0 is divided into two 4-bit pieces of information, one for book type, which indicates the type of a specification book, and the other for a part version, which indicates the part version of a specification book. A disadvantage of this arrangement is that only 4 bits can be used in expressing all part versions, thus only limited versions can be expressed. That is, 4 bits can represent only 16 different part versions which are presented in the form of n.x.

Meanwhile, when a disc which can record/update or reproduce data is installed in a recording/reproducing apparatus, the part version in a physical format information zone is read and then it is determined whether or not the part version can be recorded/updated or reproduced in the recording/reproducing apparatus. Such a determination can be made because the drive of the apparatus has the part version which was a base in designing the recording/reproducing apparatus, and the drive also has information on part versions that have compatibility with the recording/reproducing apparatus (among all part versions that had been known until the recording/reproducing apparatus was made).

This arrangement is disadvantageous because the part version shown in FIG. 1 only contains part versions that had been in existence at the time the corresponding recording medium was made, and therefore may not be compatible with part versions revised after the time of manufacturing.

The same holds true for information on the physical format information zone. When new data is recorded (due to revision) in a reserved zone, or the physical format information zone, it is unclear whether the recording/reproducing apparatus will be compatible with the revised specification.

In a normal reproduction-dedicated disc, no fatal errors (such as erasing recorded information) will occur when it is determined that a zone is a physical format information zone reserved by the specification at the time of designing the reproducing apparatus. Therefore, a method is used which ignores reserved physical formation information and the like. This is done to minimize booting time for reading or writing in a recording medium at initialization. Also, even when certain data exists in the zone, the reproducing apparatus cannot determine what operations to perform.

However, ignoring information in the reserved zones can cause problems. When the information in the physical format information zone (determined to be a reserved zone by the specification of a disc) defines other characteristics of recording/reproducing, the difference between characteristics in recording/reproducing can cause the recordation of wrong information, the loss of recorded information, updating failure, or loss of existing recorded information.

For example, when recording prevention information for data is recorded in a reserved physical format information zone, a recording/reproducing apparatus having a previous specification cannot recognize this recording prevention information, and therefore, recorded data can be erased or updated even when the user sets a protection mode by using recording prevention information.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a recording medium for storing extended version information to determine in a recording/reproducing apparatus whether or not recording/updating or reproducing can be performed on the recording medium which is made in compliance with a newly revised specification.

It is another object to provide a recording medium for storing the latest part version that can maintain recording/updating compatibility and the latest part version that can maintain reproducing compatibility, when part versions are recorded so that a recording medium having an updated specification can correctly record/update or reproduce data in a recording/reproducing apparatus having an existing specification.

It is another object to provide a managing method for correctly operating a recording/reproducing apparatus without damaging user data or without reproducing wrong information, making the recording/reproducing apparatus determine whether or not a recording medium for recording/updating or reproducing can be handled with compatibility, using extended part version information recorded on the recording medium.

It is another object to provide a managing method for reducing time in reading and writing data on a recording medium by processing the reserved zone in a control information zone, based upon extended part version information recorded on the recording medium.

It is another object to provide an apparatus for recording/reproducing without damaging user data or without reproducing wrong information by determining whether or not a recording medium for recording/updating or reproducing can be handled with compatibility, using extended part version information.

Additional objects and advantages of the invention will be set forth in part in the description which follows, and, in part, will be obvious from the description, or may be learned by practice of the invention.

5 The foregoing objects of the present invention are achieved by providing a method of recording compatibility information on a recording medium, comprising providing a physical format information zone having a reserved zone, and recording extended part version information in the reserved zone of the physical format information zone. The extended part version information comprises a detailed extended part version, a latest part version having recording compatibility, and a latest part version having reproducing compatibility. The
10 detailed extended part version, latest part version having recording compatibility, and latest part version having reproducing compatibility are in the form n.xy or n.x.

15 The above objects of the present invention may also be achieved with a recording medium comprising a physical format information zone having a reserved zone and extended part version information in the reserved zone. This extended part version information comprises a detailed extended part version, a latest part version having recording compatibility, and a latest part version having reproducing compatibility, all recorded in the form n.xy or n.x. The reserved zone is 6 bytes in size, and the detailed extended part version, latest part version having recording compatibility, and latest part version having reproducing compatibility are each 2 bytes in size.

20 The above objects of the present invention may also be achieved with a method of determining compatibility between a recording medium and a recording/reproducing apparatus, comprising installing the recording medium in the recording/reproducing apparatus, comparing a base part version of the recording/reproducing apparatus with a detailed extended part version stored in a reserved zone of a physical format information zone of the recording
25 medium, and determining recording compatibility based upon comparing the base part version with the detailed extended part version. This method further comprises comparing the base part version with a latest part version having a recording compatibility, in order to determine the recording compatibility. This method further comprises comparing the base part version

with a latest part version having a reproducing compatibility, to determine the reproducing compatibility.

The above objects of the present invention may also be achieved with a recording/reproducing apparatus, comprising a control means to record extended part version information on a reserved zone of a physical format information zone of a recording medium.

The above objects of the present invention may also be achieved with a recording/reproducing apparatus having a base part version that receives a recording medium having a detailed extended part version stored in a reserved zone of a physical format information zone. A comparing unit compares the base part version with the detailed extended part version in the reserved zone of the recording medium to determine recording and reproducing compatibility between the recording medium and the recording/reproducing apparatus.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and advantages of the invention will become apparent and more readily appreciated from the following description of the preferred embodiments, taken in conjunction with the accompanying drawings of which:

FIG. 1 illustrates part version information in the existing digital versatile discs (DVD);

FIG. 2 illustrates part version information for maintaining recording and/or reproducing compatibility according to a first embodiment of the present invention;

FIG. 3A illustrates the reading and writing compatibility between a disc in which part version information is recorded by the existing method, and a drive for determining the part version information. FIG. 3B illustrates the reading and writing compatibility between a disc, in which part version information for maintaining recording and/or reproducing compatibility according to a first embodiment of the present invention is recorded, and a drive for determining the part version information;

FIG. 4 illustrates part version information for maintaining recording and/or reproducing compatibility according to a second embodiment of the present invention.

FIG. 5 is a block diagram of an optical recording/reproducing apparatus to which the present invention is applied; and

FIG. 6 is a flowchart showing an embodiment of a method of managing part version information for maintaining recording/reproducing compatibility according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference will now be made in detail to the present preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout.

FIG. 2 illustrates part version information for maintaining recording and/or reproducing compatibility according to a first embodiment of the present invention.

In order to solve the problem that the 4 bits in the physical format information zone of FIG. 1 are not enough to express all part versions, part values may also be defined in other locations. The value of these 4 bits indicates that the part version is defined in another location, namely the location of an extended part version shown in FIG. 2.

By using data in a reserved zone that is not used in the existing physical format information zone, extended part version information is recorded. An extended part version includes:

- 1) a detailed extended part version;
- 2) the latest part version having recording (write) compatibility; and
- 3) the latest part version having reproducing (read) compatibility.

The marking method of a part version according to the this first embodiment uses 6-byte reserved bytes that are not used in a zone for recording physical format information in the existing DVD specification. A detailed extended part version is recorded on the first two reserved bytes (RBP0, RBP1), which correspond to BP17, BP 18 of the physical format information zone. Within these bytes, the highest 4 bits (b12-15) are allotted as reserved bits. In the next 4 bits (b8-b11), the integer part of the part version is written in hexadecimal numbers, and in the next 4 bits (b4-b7), the first decimal place of the part version is written in

hexadecimal numbers. In the lowest 4 bits (b0-b3), the second decimal place of the part version is written in hexadecimal numbers. The advantage of this marking method is that more detailed specifications can be marked compared to the existing 4-bit marking method.

The latest part version having recording (write) compatibility is written in RBP2 and RBP3, and the latest part version having reproducing (read) compatibility is written in RBP4 and RBP5, both using the same marking method. (Reserved byte positions RB2-RB5 correspond to BP19-BP22 of the physical format information zone).

As an example of a specification expressed according to this embodiment, part version 2.03 is expressed in hexadecimal '0203h'. Therefore, while the existing method expresses a part version in the form of n.x, this first embodiment expresses an extended part version n.xy. Here, n represents a specification change, x represents a specification change having no compatibility, and y represents a minor change having recording/reproducing compatibility, for example, the addition of an additional function. In FIG. 2, a new part version is defined, including an extended part version, the latest part version having reproducing compatibility, and the latest part version having recording compatibility. However, the present invention permits many variations, for example, a part version having only an extended part version, and no latest part version reproducing or latest part version recording information.

In order to assure compliance with changing industry specifications, b0-b15 are set to '0000h' if a part version extension is not available, or does not contain any functional change. If the second decimal place is not available, or does not contain any functional change, then b0-b3 are set to '1111h'. This will keep the disc within specification if the industry format book changes in the future.

For information on the newly defined part version, the reserved zone that is not used in the physical format information zone can be used. For example, the 6 bytes from the 17th byte to the 22nd byte in the physical format information zone can be used. Thus, RBP0 in FIG. 2 corresponds to BP17 of the physical format information zone, RBP1 corresponds to BP18, etc.

The latest part version having recording compatibility indicates that the corresponding recording medium, which was manufactured based upon the specification defined in an extended part version, can record and update data, maintaining compatibility with a

recording/reproducing apparatus, which was manufactured based upon the latest part version having recording compatibility.

The latest part version having reproducing compatibility indicates that the corresponding recording medium, which was manufactured based upon the specification defined in an extended part version, can correctly read recorded data, maintaining compatibility with a recording/reproducing apparatus, which was manufactured based upon the latest part version having reproducing compatibility.

Therefore, when a recording medium having an arbitrary part version is installed in a recording/reproducing apparatus which was manufactured based upon a specification having a predetermined part version, the apparatus operates based upon the part version which was a base of the recording/reproducing apparatus, the detailed part version of the recording medium, the latest part version having recording compatibility, and the latest part version having reproducing compatibility.

That is, when the base part version of the recording/reproducing apparatus is a version prior to the latest part version having recording compatibility, writing is prohibited to prevent damaging data or errors. When the base part version of the recording/reproducing apparatus came later than the latest part version having recording compatibility with the recording medium, recording and updating can be performed.

The same operation applies with respect to determining reproducing compatibility.

FIG. 3A illustrates the reading and writing compatibility between a disc, in which part version information is recorded by the existing method, and a drive for determining the part version information. FIG. 3B illustrates this same reading and writing compatibility when the part version information is recorded according to the first embodiment of the present invention. That is, in the prior art, when a disc 1 with part version 2.0 is installed in a drive 3 with part version 2.0, reproducing (reading) and recording (writing) data on/from the disc 1 can be performed. However, when the disc 2 with part version 2.3 is installed in drive 3 with part version 2.0, it is unclear whether or not the recording medium has compatibility with the drive.

However, as shown in FIG. 3B, in the first embodiment of the present invention, when a disc 11 with extended part version 2.0, a latest reproducing (read) compatible part version of 1.9, and a latest recording (write) compatible part version of 1.9, is installed in a drive 13 with part version 2.0, or in a drive 14 with part version 1.9, it is clear that reproducing and recording data on/from the disc 11 can be performed. Furthermore, when a disc 12 with extended part version 2.3, whose latest part version having reproducing compatibility is 1.9, and whose latest part version having recording compatibility is 2.0 is installed in the drive 13 whose part version is 2.0, it is clear that recording and reproducing data on/from the disc 12 can be performed, while the disc 12 is installed in the drive 14 whose part version is 1.9, it is clear that reproducing data from the disc 12 can be performed but recording data on the disc 12 cannot be performed.

FIG. 4 illustrates part version information for maintaining recording and/or reproducing capability according to a second embodiment of the present invention.

This embodiment uses 2 bytes (RBP0,RBP1) in the physical format information zone, and expresses part version as two digits. Within these bytes, the highest 4 bits (b12-15) are an identification for extended part version. If extended part version is used, then this field is set to '1000'h. If extended part version is not used, then this field is set to '0000'h. The next 4 bits (b8-11) are reserved. The next 4 bits (b4-7) record the primary digit of the part version, and the lowest 4 bits (b0-3) record the first sub-digit of the part version. Reserved bytes RBP2-RBP5 are bit mapped in a like manner.

This embodiment may be used when the part version is not already defined in BP0. When the part version is not already defined at BP0, the part version field is set to '1111'h. When the part version is already defined at BP0, then the method of recording extended part version of this second embodiment is not necessary.

FIG. 5 is a block diagram of an audio/video (A/V) data recording/reproducing apparatus 170 to implement the present invention. The function of the apparatus can be divided into recording and reproducing. Also, a recording medium according to the present invention can be designed so that reproducing compatibility can be determined when the medium is installed in a reproducing apparatus having only a reproducing function.

In recording, an A/V codec and/or host interface 110 compresses and encodes, in a predetermined compression scheme, an A/V signal input from the outside, and supplies information on the size of the compressed data. A digital signal processor (DSP) 120 receives the compressed A/V data from the A/V codec and/or host interface 110, adds additional data for error correction code (ECC) processing, and modulates the data in a predetermined modulation scheme. A high frequency amplifier (referred to as RF AMP) 130 converts the modulated data supplied from the DSP 120 into an RF signal. A pick-up unit 140 records the RF signal supplied from the RF AMP 130 onto a disc installed on a turntable. Servo unit 150 receives information required for servo control from a system controller 160 and stably performs a servo function for the installed disc.

When data stored on the disc is reproduced, the pick-up unit 140 picks up data from the disc in the form of an optical signal, and the data is extracted from the optical signal. The RF AMP 130 converts the optical signal into an electrical signal, and extracts a servo signal and modulated data in order to perform a servo function. The DSP 120 demodulates the modulated data supplied from the RF AMP 130 in a scheme corresponding to the modulation scheme which was used in modulation, and performs ECC to correct errors and to remove additional data. The servo unit 150 receives information required for servo control from the RF AMP 130 and the system controller 160, and stably performs the servo function. The A/V codec and/or host interface 110 decodes compressed A/V data supplied from the DSP 120 and outputs an A/V signal. The system controller 160, which supplies an interface to a user, controls the entire system.

When the disc is initialized, the system controller 160 generates the extended part version, the latest part version having reproducing compatibility, and the latest part version having recording compatibility with the disc installed in a recording/reproducing apparatus. The system controller 160 then records this information on the reserved zone of the physical format information zone in the control data block of the disc through the DSP 120, the RF AMP 130, and the pick-up unit 140.

When data is recorded/updated, the system controller 160 controls the recording operation by determining permission or prohibition of recording/updating data, based upon the

extended part version and the latest part version having recording compatibility, and then informs a user of the result of this determination through a user interface (not shown).

Likewise, when data is reproduced, the system controller 160 controls the reproducing operation by determining permission or prohibition of reproducing data, based on the extended part version and the latest part version having reproducing compatibility, and then informs the user of the result of this determination through the user interface.

FIG. 6 is a flowchart showing an embodiment of a method of managing part version information for maintaining recording/reproducing compatibility according to the present invention.

In step S1, a recording medium (a disc) is installed in a recording/reproducing apparatus. In step S2, the base part version at the time of manufacturing of the recording/reproducing apparatus is compared with the extended part version stored in the physical format information zone of the recording medium. In step S3, it is determined whether or not the comparison in step S2 indicates that the part versions have recording compatibility. When the base part version of the recording/reproducing apparatus is equal to or later than the latest part version having recording compatibility stored in the recording medium, recording/updating/reproducing operations are permitted in step S4. When the result of step S3 indicates that the base part version has no recording compatibility, it is determined whether or not the base part version has reproducing compatibility in step S5. When the base part version of the recording/reproducing apparatus is equal to or later than the latest part version having reproducing compatibility in the recording medium, only a reproducing operation is permitted in step S6. At this point, a step may be added in which a user is informed that recording cannot be performed.

When the result of S5 indicates the base part version has neither recording compatibility nor reproducing compatibility, recording/reproducing operations are prohibited in step S7. At this point, a step may be added in which a user is informed that recording/reproducing cannot be performed.

Though the embodiments related to a DVD-ROM and a DVD-RAM are explained above, the present invention can be applied to the specifications of all DVDs that can record or reproduce data.

As described above, the present invention maintains compatibility with the method for managing part version defined in the current DVD specifications, and safely ignores information in a reserved zone in a control information zone which a recording/reproducing apparatus cannot read. By doing so, the present invention reduces booting time between the first action of a disc in a recording/reproducing apparatus, and the time when the recording/reproducing apparatus starts to read or write data.

Also, the present invention enables accurate determination of compatibility between a recording/reproducing apparatus having a previous part version and a recording medium having a new part version. This maximizes recording/reproducing compatibility between a recording/reproducing apparatus and a recording medium.

Although a few preferred embodiments of the present invention have been shown and described, it would be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents.

CLAIMS

What is Claimed Is:

- 1 1. A method of recording compatibility information on a recording medium,
2 comprising:
3 providing a physical format information zone having a reserved zone; and
4 recording extended part version information in the reserved zone of the physical
5 format information zone, said recording of the extended part version information comprising
6 recording a detailed extended part version comprising a primary digit in the reserved zone.
7
- 8 2. The method of claim 1, wherein the recording of the extended part version
9 information further comprises recording a latest part version having recording compatibility
10 with a recording/reproducing apparatus of a given specification level in the reserved zone.
- 1 3. The method of claim 2, wherein the recording of the extended part version
2 information further comprises recording a latest part version having reproducing compatibility
3 with the recording/reproducing apparatus in the reserved zone.
- 4 4. The method of claim 3, wherein the recording of the latest part version having
5 recording compatibility with the recording/reproducing apparatus, and the recording of the
6 latest part version having reproducing compatibility with the recording/reproducing apparatus,
7 each further comprise recording a primary digit in the reserved zone.
- 8 5. The method of claim 4, wherein the recording of the detailed extended part version,
9 the recording of the latest part version having recording compatibility with the
10 recording/reproducing apparatus, and the recording of the latest part version having
1 reproducing compatibility with the recording/reproducing apparatus each further comprise
2 recording a first sub-digit immediately after the first decimal place.

1 6. The method of claim 5, further comprising recording said primary digit, and said
2 first sub-digit in the form of n.x.

1 7. The method of claim 6, wherein n represents a specification change, and x
2 represents a specification change having no compatibility with the recording/reproducing
3 apparatus.

1 8. The method of claim 7, further comprising recording non-extended part version
2 information in an unreserved zone of the physical format information zone, wherein said
3 non-extended part version information indicates that the extended part version information is
4 recorded in a different location.

5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180
181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381
382
383
384
385
386
387
388
389
390
391
392
393
394
395
396
397
398
399
400
401
402
403
404
405
406
407
408
409
410
411
412
413
414
415
416
417
418
419
420
421
422
423
424
425
426
427
428
429
430
431
432
433
434
435
436
437
438
439
440
441
442
443
444
445
446
447
448
449
450
451
452
453
454
455
456
457
458
459
460
461
462
463
464
465
466
467
468
469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484
485
486
487
488
489
490
491
492
493
494
495
496
497
498
499
500
501
502
503
504
505
506
507
508
509
510
511
512
513
514
515
516
517
518
519
520
521
522
523
524
525
526
527
528
529
530
531
532
533
534
535
536
537
538
539
540
541
542
543
544
545
546
547
548
549
550
551
552
553
554
555
556
557
558
559
560
561
562
563
564
565
566
567
568
569
570
571
572
573
574
575
576
577
578
579
580
581
582
583
584
585
586
587
588
589
590
591
592
593
594
595
596
597
598
599
600
601
602
603
604
605
606
607
608
609
610
611
612
613
614
615
616
617
618
619
620
621
622
623
624
625
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
652
653
654
655
656
657
658
659
660
661
662
663
664
665
666
667
668
669
670
671
672
673
674
675
676
677
678
679
680
681
682
683
684
685
686
687
688
689
690
691
692
693
694
695
696
697
698
699
700
701
702
703
704
705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721
722
723
724
725
726
727
728
729
730
731
732
733
734
735
736
737
738
739
740
741
742
743
744
745
746
747
748
749
750
751
752
753
754
755
756
757
758
759
760
761
762
763
764
765
766
767
768
769
770
771
772
773
774
775
776
777
778
779
780
781
782
783
784
785
786
787
788
789
790
791
792
793
794
795
796
797
798
799
800
801
802
803
804
805
806
807
808
809
810
811
812
813
814
815
816
817
818
819
820
821
822
823
824
825
826
827
828
829
830
831
832
833
834
835
836
837
838
839
840
841
842
843
844
845
846
847
848
849
850
851
852
853
854
855
856
857
858
859
860
861
862
863
864
865
866
867
868
869
870
871
872
873
874
875
876
877
878
879
880
881
882
883
884
885
886
887
888
889
890
891
892
893
894
895
896
897
898
899
900
901
902
903
904
905
906
907
908
909
910
911
912
913
914
915
916
917
918
919
920
921
922
923
924
925
926
927
928
929
930
931
932
933
934
935
936
937
938
939
940
941
942
943
944
945
946
947
948
949
950
951
952
953
954
955
956
957
958
959
960
961
962
963
964
965
966
967
968
969
970
971
972
973
974
975
976
977
978
979
980
981
982
983
984
985
986
987
988
989
990
991
992
993
994
995
996
997
998
999
1000
1001
1002
1003
1004
1005
1006
1007
1008
1009
1010
1011
1012
1013
1014
1015
1016
1017
1018
1019
1020
1021
1022
1023
1024
1025
1026
1027
1028
1029
1030
1031
1032
1033
1034
1035
1036
1037
1038
1039
1040
1041
1042
1043
1044
1045
1046
1047
1048
1049
1050
1051
1052
1053
1054
1055
1056
1057
1058
1059
1060
1061
1062
1063
1064
1065
1066
1067
1068
1069
1070
1071
1072
1073
1074
1075
1076
1077
1078
1079
1080
1081
1082
1083
1084
1085
1086
1087
1088
1089
1090
1091
1092
1093
1094
1095
1096
1097
1098
1099
1100
1101
1102
1103
1104
1105
1106
1107
1108
1109
1110
1111
1112
1113
1114
1115
1116
1117
1118
1119
1120
1121
1122
1123
1124
1125
1126
1127
1128
1129
1130
1131
1132
1133
1134
1135
1136
1137
1138
1139
1140
1141
1142
1143
1144
1145
1146
1147
1148
1149
1150
1151
1152
1153
1154
1155
1156
1157
1158
1159
1160
1161
1162
1163
1164
1165
1166
1167
1168
1169
1170
1171
1172
1173
1174
1175
1176
1177
1178
1179
1180
1181
1182
1183
1184
1185
1186
1187
1188
1189
1190
1191
1192
1193
1194
1195
1196
1197
1198
1199
1200
1201
1202
1203
1204
1205
1206
1207
1208
1209
1210
1211
1212
1213
1214
1215
1216
1217
1218
1219
1220
1221
1222
1223
1224
1225
1226
1227
1228
1229
1230
1231
1232
1233
1234
1235
1236
1237
1238
1239
1240
1241
1242
1243
1244
1245
1246
1247
1248
1249
1250
1251
1252
1253
1254
1255
1256
1257
1258
1259
1260
1261
1262
1263
1264
1265
1266
1267
1268
1269
1270
1271
1272
1273
1274
1275
1276
1277
1278
1279
1280
1281
1282
1283
1284
1285
1286
1287
1288
1289
1290
1291
1292
1293
1294
1295
1296
1297
1298
1299
1300
1301
1302
1303
1304
1305
1306
1307
1308
1309
1310
1311
1312
1313
1314
1315
1316
1317
1318
1319
1320
1321
1322
1323
1324
1325
1326
1327
1328
1329
1330
1331
1332
1333
1334
1335
1336
1337
1338
1339
1340
1341
1342
1343
1344
1345
1346
1347
1348
1349
1350
1351
1352
1353
1354
1355
1356
1357
1358
1359
1360
1361
1362
1363
1364
1365
1366
1367
1368
1369
1370
1371
1372
1373
1374
1375
1376
1377
1378
1379
1380
1381
1382
1383
1384
1385
1386
1387
1388
1389
1390
1391
1392
1393
1394
1395
1396
1397
1398
1399
1400
1401
1402
1403
1404
1405
1406
1407
1408
1409
1410
1411
1412
1413
1414
1415
1416
1417
1418
1419
1420
1421
1422
1423
1424
1425
1426
1427
1428
1429
1430
1431
1432
1433
1434
1435
1436
1437
1438
1439
1440
1441
1442
1443
1444
1445
1446
1447
1448
1449
1450
1451
1452
1453
1454
1455
1456
1457
1458
1459
1460
1461
1462
1463
1464
1465
1466
1467
1468
1469
1470
1471
1472
1473
1474
1475
1476
1477
1478
1479
1480
1481
1482
1483
1484
1485
1486
1487
1488
1489
1490
1491
1492
1493
1494
1495
1496
1497
1498
1499
1500
1501
1502
1503
1504
1505
1506
1507
1508
1509
1510
1511
1512
1513
1514
1515
1516
1517
1518
1519
1520
1521
1522
1523
1524
1525
1526
1527
1528
1529
1530
1531
1532
1533
1534
1535
1536
1537
1538
1539
1540
1541
1542
1543
1544
1545
1546
1547
1548
1549
1550
1551
1552
1553
1554
1555
1556
1557
1558
1559
1560
1561
1562
1563
1564
1565
1566
1567
1568
1569
1570
1571
1572
1573
1574
1575
1576
1577
1578
1579
1580
1581
1582
1583
1584
1585
1586
1587
1588
1589
1590
1591
1592
1593
1594
1595
1596
1597
1598
1599
1600
1601
1602
1603
1604
1605
1606
1607
1608
1609
1610
1611
1612
1613
1614
1615
1616
1617
1618
1619
1620
1621
1622
1623
1624
1625
1626
1627
1628
1629
1630
1631
1632
1633
1634
1635
1636
1637
1638
1639
1640
1641
1642
1643
1644
1645
1646
1647
1648
1649
1650
1651
1652
1653
1654
1655
1656
1657
1658
1659
1660
1661
1662
1663
1664
1665
1666
1667
1668
1669
1670
1671
1672
1673
1674
1675
1676
1677
1678
1679
1680
1681
1682
1683
1684
1685
1686
1687
1688
1689
1690
1691
1692
1693
1694
1695
1696
1697
1698
1699
1700
1701
1702
1703
1704
1705
1706
1707
1708
1709
1710
1711
1712
1713
1714
1715
1716
1717
1718
1719
1720
1721
1722
1723
1724
1725
1726
1727
1728
1729
1730
1731
1732
1733
1734
1735
1736
1737
1738
1739
1740
1741
1742
1743
1744
1745
1746
1747
1748
1749
1750
1751
1752
1753
1754
1755
1756
1757
1758
1759
1760
1761
1762
1763
1764
1765
1766
1767
1768
1769
1770
1771
1772
1773
1774
1775
1776
1777
1778
1779
1780
1781
1782
1783
1784
1785
1786
1787
1788
1789
1790
1791
1792
1793
1794
1795
1796
1797
1798
1799
1800
1801
1802
1803
1804
1805
1806
1807
1808
1809
1810
1811
1812
1813
1814
1815
1816
1817
1818
1819
1820
1821
1822
1823
1824
1825
1826
1827
1828
1829
1830
1831
1832
1833
1834
1835
1836
1837
1838
1839
1840
1841
1842
1843
1844
1845
1846
1847
1848
1849
1850
1851
1852
1853
1854
1855
1856
1857
1858
1859
1860
1861
1862
1863
1864
1865
1866
1867
1868
1869
1870
1871
1872
1873
1874
1875
1876
1877
1878
1879
1880
1881
1882
1883
1884
1885
1886
1887
1888
1889
1890
1891
1892
1893
1894
1895
1896
1897
1898
1899
1900
1901
1902
1903
1904
1905
1906
1907
1908
1909
1910
1911
1912
1913
1914
1915
1916
1917
1918
1919
1920
1921
1922
1923
1924
1925
1926
1927
1928
1929
1930
1931
1932
1933
1934
1935
1936
1937
1938
1939
1940
1941
1942
1943
1944
1945
1946
1947
1948
1949
1950
1951
1952
1953
1954
1955
1956
1957
1958
1959
1960
1961
1962
1963
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
2041
2042
2043
2044
2045
2046
2047
2048
2049
2050
2051
2052
2053
2054
2055
2056
2057
2058
2059
2060
2061
2062
2063
2064
2065
2066
2067
2068
2069
2070
2071
2072
2073
2074
2075
2076
2077
2078
2079
2080
2081
2082
2083
2084
2085
2086
2087
2088
2089
2090
2091
2092
2093
2094
2095
2096
2097
2098
2099
2100
2101
2102
2103
2104
2105
2106
2107
2108
2109
2110
2111
2112
2113
2114
2115
2116
2117
2118
2119
2120
2121
2122
2123
2124
2125
2126
2127
2128
2129
2130
2131
2132
2133
2134
2135
2136
2137
2138
2139
2140
2141
2142
2143
2144
2145
2146
2147
2148
2149
2150
2151
2152
2153
2154
2155
2156
2157
2158
2159
2160
2161
2162
2163
2164
2165
2166
2167
2168
2169
2170
2171
2172
2173
2174
2175
2176
2177
2178
2179
2180
2181
2182
2183
2184
2185
2186
2187
2188
2189
2190
2191
2192
2193
2194
2195
2196
2197
2198
2199

having reproducing compatibility with the recording/reproducing apparatus each further comprise a primary digit.

13. The recording medium of claim 12, wherein said detailed extended part version, said latest part version having recording compatibility with the recording/reproducing apparatus, and said latest part version having reproducing compatibility with the recording/reproducing apparatus each further comprise a first sub-digit.

14. The recording medium of claim 13, wherein said primary digit and said first sub-digit are in the format n.x.

15. The recording medium of claim 14, wherein n represents a specification change, and x represents a specification change having no compatibility with the recording/reproducing apparatus.

16. The recording medium of claim 15, wherein said reserved zone is 6 bytes in size, and said detailed extended part version, said latest part version having recording compatibility with the recording/reproducing apparatus, and said latest part version having reproducing compatibility with the recording/reproducing apparatus, are each 2 bytes in size.

17. The recording medium of claim 16, wherein said primary digit and said first sub-digit are each 4 bits in size.

18. The recording medium of claim 17, wherein said physical format information zone further comprises an unreserved part version zone 4 bits in size, wherein said unreserved part version zone is located at a byte position 0 of said physical format information zone, and said reserved zone of said physical format information zone is located at a byte position 17 through a byte position 22 of said physical format information zone.

1 19. The recording medium of claim 18, wherein said detailed extended part version is
2 located at said byte position 17 through a byte position 18 of said physical format information
3 zone, said latest part version having recording compatibility with the recording/reproducing
4 apparatus is located at a byte position 19 through a byte position 20 of said physical format
5 information zone, and said latest part version having reproducing compatibility with the
6 recording/reproducing apparatus is located at a byte position 21 through said byte position 22
7 of said physical format information zone.

1 20. The recording medium of claim 19, wherein said primary digit is located at a bit 4
2 through a bit 7 of said byte positions 17 through 22 of said physical format information zone,
3 and said first sub-digit is located at a bit 0 through a bit 3 of byte positions 17 through 22 of
4 said physical format information zone.

1 21. The recording medium of claim 20, wherein the recording medium is a digital
2 versatile disc (DVD).

1 22. A method of determining compatibility between a recording medium and a
2 recording/reproducing apparatus, comprising:

3 installing said recording medium in said recording/reproducing apparatus;

4 comparing a base part version of the recording/reproducing apparatus with a detailed
5 extended part version stored in a reserved zone of a physical format information zone of said
6 recording medium; and

7 determining recording compatibility based upon said step of comparing said base part
8 version with said detailed extended part version,
9 wherein said detailed extended part version is recorded in the form of n.x.

1 23. A method of determining compatibility between a reproducing medium and a
2 recording/reproducing apparatus, comprising:

3 installing said reproducing medium in said recording/reproducing apparatus;

4 comparing a base part version of the recording/reproducing apparatus with a detailed
5 extended part version stored in a reserved zone of a physical format information zone of said
6 reproducing medium; and

7 determining reproducing compatibility based upon said step of comparing said base part
8 version with said detailed extended part version
9 wherein said detailed extended part version is recorded in the form of n.x.

1 24. The method of claim 22, wherein said comparing of said base part version with
2 said detailed extended part version further comprises comparing said base part version with a
3 latest part version having recording compatibility with the recording/reproducing apparatus
4 stored in said reserved zone.

5 25. The method of claim 23, further comprising:
6 comparing said base part version with a latest part version having reproducing
7 compatibility with the recording/reproducing apparatus stored in said reserved zone; and
8 determining a reproducing compatibility between the recording medium and the
9 recording/reproducing apparatus based upon said step of comparing said base part version with
10 said latest part version having reproducing compatibility with the recording/reproducing
11 apparatus.

12 26. The method of claim 25, wherein said reserved zone is 6 bytes in size, and said
13 latest part version having recording compatibility with the recording/reproducing apparatus,
14 and said latest part version having reproducing compatibility with the recording/reproducing
15 apparatus are each in the form of n.x, wherein n represents a specification change, and x
16 represents a specification change having no compatibility with the recording/reproducing
17 apparatus.

1 27. The method of claim 26, wherein said reserved zone is located at a byte position
2 17 through a byte position 22 of said recording medium.

1 28. The method of claim 25, wherein if the determining of the recording compatibility
2 indicates that there is recording compatibility, then recording is permitted, and if the
3 determining of the recording compatibility indicates that there is not recording compatibility,
4 then recording is prohibited;

5 and if the determining of the reproducing compatibility indicates that there is
6 reproducing compatibility, then the reproducing is permitted, and if the determining of the
7 reproducing compatibility indicates that there is not reproducing compatibility, then
8 reproducing is prohibited.

1 29. A recording/reproducing apparatus, comprising:
2 a control unit to record extended part version information in a reserved zone of a
3 physical format information zone of a recording medium, and
4 a reading unit to read the extended part version information from the recording
5 medium, wherein the extended part version information in the reserved zone comprises a
6 primary digit.

1 30. The recording/reproducing apparatus of claim 29, wherein the extended part
2 version information comprises a detailed extended part version.

3 31. The recording/reproducing apparatus of claim 30, wherein the extended part
4 version information further comprises a latest part version having recording compatibility with
5 the recording/reproducing apparatus in the reserved zone.

1 32. The recording/reproducing apparatus of claim 31, wherein the extended part
2 version comprises a latest part version having reproducing compatibility with the
3 recording/reproducing apparatus.

1 33. The recording/reproducing apparatus of claim 32, wherein the extended part
2 version information in the reserved zone comprises a first sub-digit immediately after said
3 primary digit.

1 34. The recording/reproducing apparatus of claim 33, wherein the control means
2 records said primary digit, and said first sub-digit in the form n.x.

1 35. The recording/reproducing apparatus of claim 34, wherein n represents a
2 specification change, and x represents a specification change having no compatibility with the
3 recording/reproducing apparatus.

4 36. The recording/reproducing apparatus of claim 35, wherein said detailed extended
5 part version further comprises a latest part version having recording compatibility, and the
6 comparing unit compares said base part version with said detailed extended part version by
7 comparing said base part version with the latest part version having recording compatibility
8 with the recording/reproducing apparatus stored in said reserved zone.

ABSTRACT

A method of recording read/write compatibility information on an optical disc. Extended part version information, latest part version having recording capability, and latest part version having reproducing capability are stored in either n.xy or n.x. form on 6 bytes of a reserved zone of a physical format information zone of the optical disc. A recording/reproducing apparatus to record extended part version information on a reserved zone of a physical format information zone of a recording medium. The recording/reproducing apparatus has a base part version and a comparing unit to determine recording/reproducing compatibility with a recording medium having a detailed extended part version stored in a reserved zone of a physical format information zone.

FIG. 1
(PRIOR ART)

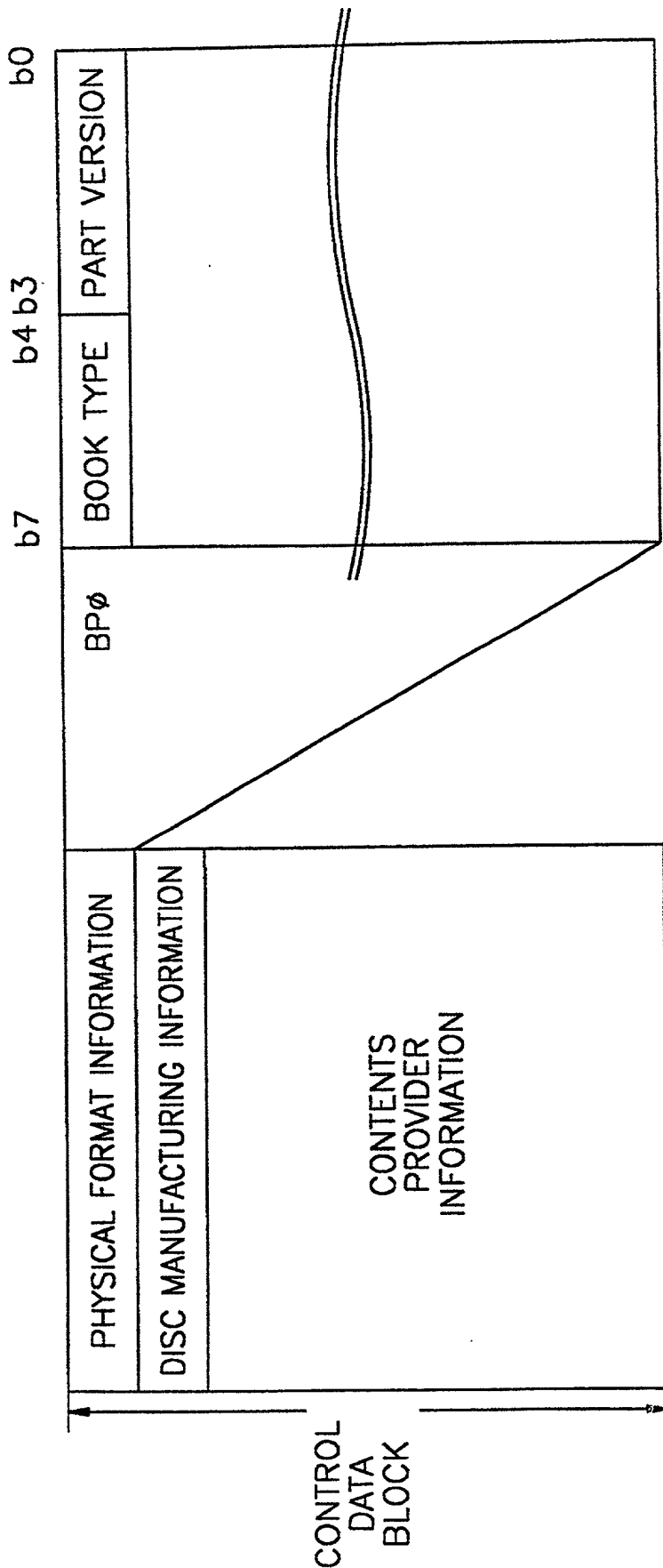


FIG. 2

	b15	b12 b11	b7	b3	b0	
RBPO,RBP1	RESERVED	INTEGER		FIRST DECIMAL PLACE	SECOND DECIMAL PLACE	EXTENDED PART VERSION
RBP2,RBP3	RESERVED	INTEGER		FIRST DECIMAL PLACE	SECOND DECIMAL PLACE	LATEST RECORDING COMPATIBLE PART VERSION
RBP4,RBP5	RESERVED	INTEGER		FIRST DECIMAL PLACE	SECOND DECIMAL PLACE	LATEST REPRODUCING COMPATIBLE PART VERSION

FIG. 3A

(PRIOR ART)

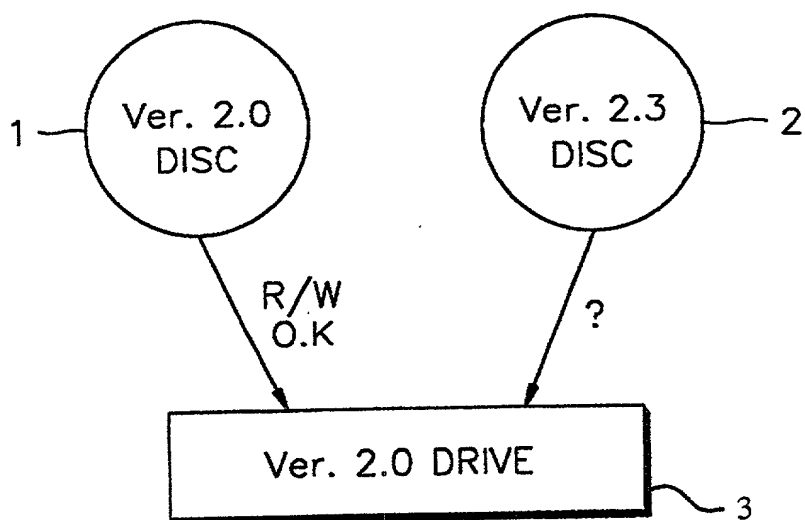


FIG. 3B

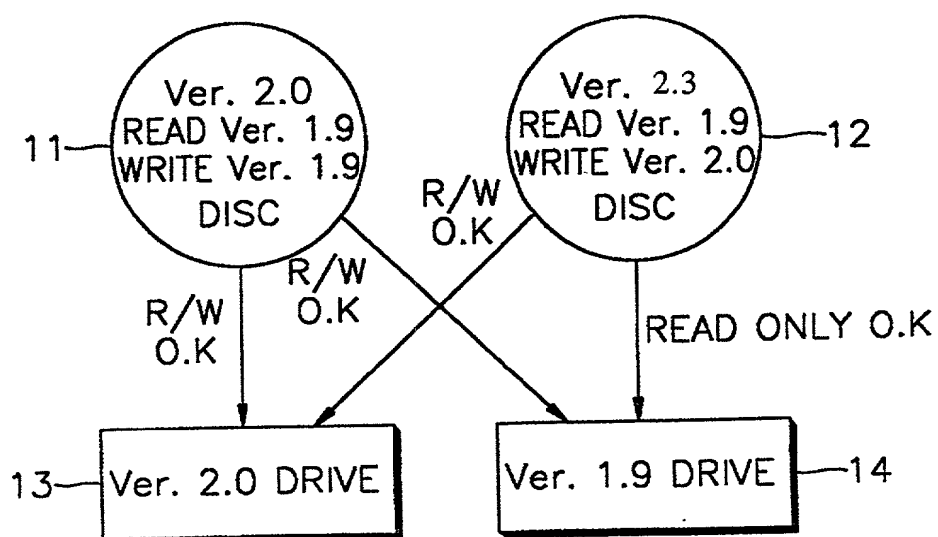


FIG. 4

	b15	b12	b11	b7	b3	b0	
RBPO,RBP1	IDENTIFIER	RESERVED	PRIMARY DIGIT	FIRST SUB-DIGIT	EXTENDED PART VERSION		
	IDENTIFIER	RESERVED	PRIMARY DIGIT	FIRST SUB-DIGIT	LATEST RECORDING COMPATIBLE PART VERSION		
	IDENTIFIER	RESERVED	PRIMARY DIGIT	FIRST SUB-DIGIT	LATEST REPRODUCING COMPATIBLE PART VERSION		

FIG. 5

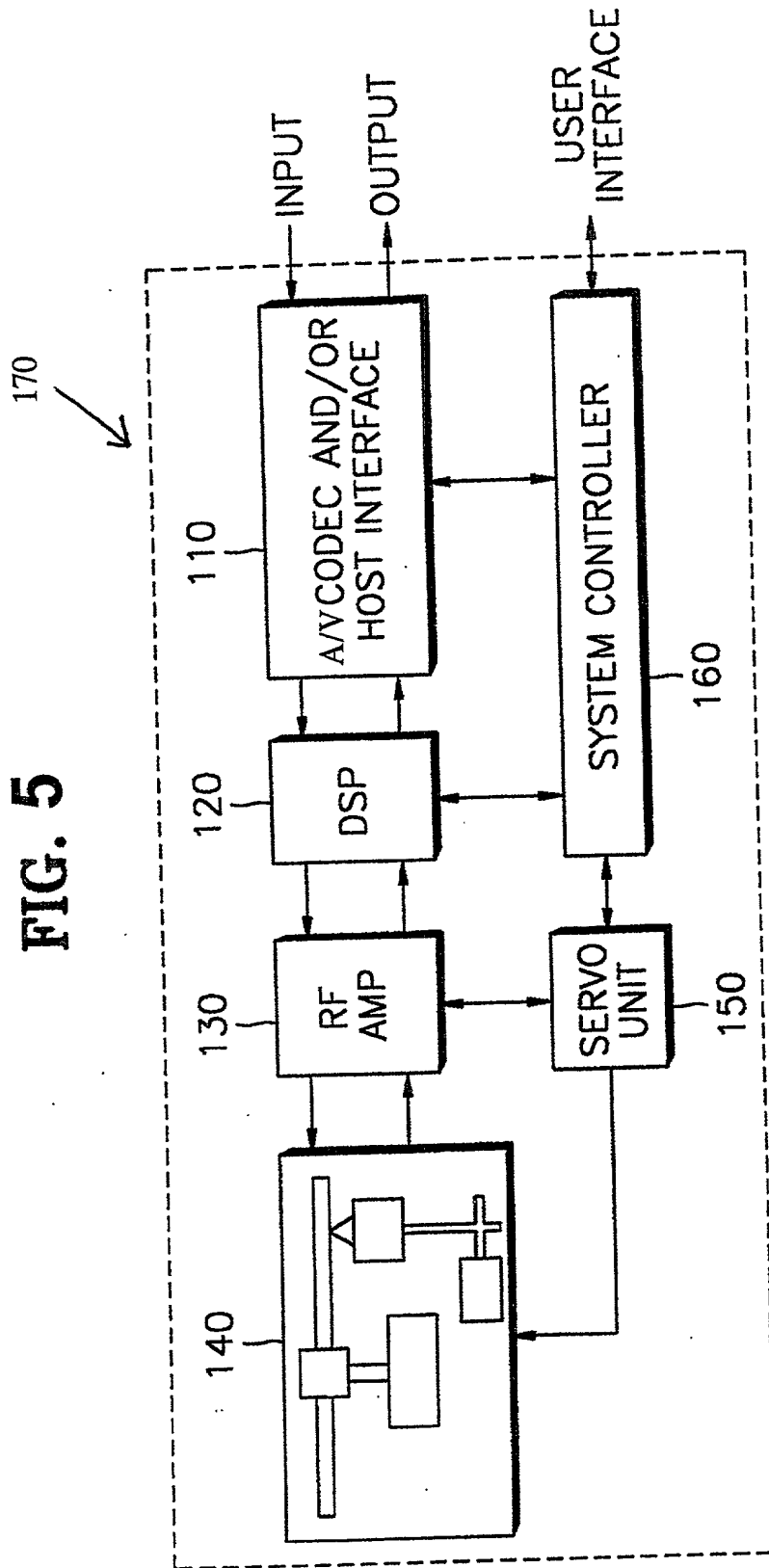


FIG. 6

